REMARKS

The foregoing amendment is submitted to more clearly set forth the claimed invention and to highlight the differences between the claimed invention and the prior art of record. Claim 1 has been amended to provide for the administration of the stabilized source of peroxide prior to the administration of ozone thus necessitating cancellation of claim 6. As will be explained hereinafter, the administration of the peroxide first followed by the administration of ozone provides the type of control which prevents aggressive/violent reactions that are typically associated with direct administration of ozone to the in situ environment together with or in advance of hydrogen peroxide. As indicated at page 7, beginning at line 6, the peroxide component may be added first to the in situ environment followed by administration of ozone. As indicated in the paragraph beginning at page 9, line 14, the peroxide and ozone may be alternately injected (i.e. peroxide added first followed by ozone) (i.e. pulsed) which may be repeated throughout the entire extent of the in situ environment.

In another embodiment, the stabilized peroxide is allowed to disburse or migrate throughout the in situ environment subsequently followed by the administration of ozone. Accordingly, there is ample support in the application for the claim language which now provides for the administration of the stabilized source of peroxide prior to the administration of ozone. As will be explained hereinafter, the

administration of stablilized source of peroxide and the ozone in the manner now specifically set forth in the present claims avoids the aggressive/violent reactions associated with the administration of ozone prior to or simultaneously with the administration of the peroxide. To emphasize the beneficial effects of the present method, Applicant has added language to claim 1 indicating the absence of aggressive reactions between the stabilized source of peroxide and the ozone at the point of administration as described at page 6, lines 19-20. Entry of the amendment to claim 1 is therefore deemed proper and is respectfully requested.

Applicant notes the claim objections set forth in paragraphs 3 and 4 of the Office Action. Claim 4 has been amended as requested by the Examiner as has claim 10. Claims 7 and 8 have been amended to make them consistent with the language specifically employed in claim 1. No new matter has been added by these amendments and entry thereof is deemed proper and is respectfully requested. It should be noted that the amendments made to claims 7 and 8 also address the rejection under 35 U.S.C. Section 112 set forth in paragraphs 5 and 6 of the Office Action.

Claims 1-20 stand rejected as obvious over the Nelson and Brown publication (Nelson-Brown) in view of Elgal (U.S. Patent No. 5,663,475) and Feasey (U.S. Patent No. 5,130,053). The Office action states that Nelson-Brown teaches several advantages of ozonation for site remediation. Elgal is stated to exemplify in situ treatment of soil contaminated with petrochemicals by injecting a process mixture of

ozone and hydrogen peroxide while Feasey is stated to teach stabilization of concentrated hydrogen peroxide solutions. The combination of these references is stated to render the claimed invention obvious to one of ordinary skill in the art. The rejection is hereby traversed and reconsideration is respectfully requested.

The present invention is directed to a method of treating contaminants in a soil-containing in situ environment. The method of claim 1 employs a stabilized source of peroxide in a specified amount as well as ozone to generate hydroxyl radicals. Of particular importance to the claimed method is the administration of the stabilized source of peroxide first, followed by the administration of ozone. An object of the invention is to provide for the controlled generation of hydroxyl radicals. The hydroxyl radicals oxidize the contaminants without generating aggressive reactions at the point of administration because this can result in the oxidizing agent being unavailable throughout the in situ environment where the treatment is to occur.

It is well known in the art that the direct administration of ozone to the in situ environment is problematic. The Nelson-Brown publication concurs. The middle column of page 18 of Nelson-Brown states that subsurface ozonation to remediate contaminated soil or groundwater has an added level of complexity. The publication goes on to state that the designers must understand how ozone reacts with different organic compounds and how the gas disperses through different soil matrices. System design is an important part of direct ozonation. Indeed, ozone transport

requires reasonably permeable homogeneous soils. If soils are heterogeneous, ozone tends to channel providing non-uniform treatment.

Page 21 of Nelson-Brown indicates that ozone spontaneously decomposes to oxygen forming hydroxyl radicals as an intermediate species. It is further stated that certain conditions favor the decomposition of ozone including when ozone is reacted with hydrogen peroxide. However, there is no teaching or suggestion in the reference of the importance of providing the in situ environment with hydrogen peroxide first, prior to the administration of ozone. Instead, the handling of ozone remains a problem and there is no recognition in the reference of the beneficial effects of having hydrogen peroxide present and dispersed when ozone is added to the in situ environment. The presence of ozone first (because of its volatility and reactivity) likely results in violent/aggressive reactions when hydrogen peroxide is added simultaneously or thereafter (i.e. the peroxide acts as a catalyst in the decomposition of ozone). The Nelson-Brown solution treats the in situ environment with ozone and adds hydrogen peroxide as a catalyst to generate hydroxyl radicals. However, this method is disadvantageous because it results in aggressive reactions at the point of injection owing to the high concentration of ozone when hydrogen peroxide is administered to the soil. The hydrogen peroxide acts as a catalyst and ozone engages in aggressive reactions, which, as explained above, is disadvantageous when trying to treat the in situ environment under controlled conditions.

It is therefore submitted that the presently claimed method is neither taught nor suggested by the Nelson-Brown publication.

Elgal (U.S. Patent No. 5,663,475) discusses in the background of the invention that military bases have groundwater treatment plants. Common to these type of plants are the use of incinerators to burn the petrochemical contaminants after they have been separated from the groundwater. Such plants and the combustion process employed therein is stated at column 1, lines 23-25 to be energy intensive and further contribute to the pollution of the atmosphere by expelling carbon dioxide and nitrogen oxides.

Under the summary of the invention set forth beginning at column 1, line 35 it is stated that the invention of the '475 Patent is the replacement of the incinerator in such groundwater treatment plants with an air stripper for stripping petrochemical contaminants from water and a vapor reactor which treats the vapor phase of the gases being expelled out of the air stripper. The groundwater treatment apparatus is shown in Figure 1 and the air stripper is identified by numeral 18.

In accordance with the summary of the invention, the petrochemical contaminants are stripped from water by the air stripper. A vapor reactor treats the vapor phase of the gases being expelled out of the air stripper. The vapor phase includes gases of volatile contaminants. The vapors are first mixed with ozone and

pumped into the vapor reactor where they are scrubbed and oxidized in a packed column in contact with high concentration hydrogen peroxide.

Thus, the summary of the invention is concerned with a groundwater treatment plant in which the incinerator has been replaced with an air stripper and the vapor phase (containing volatile contaminants) is treated first with ozone and thereafter with hydrogen peroxide. The remaining portion of the patent reference including Example 1 is entirely directed to explaining how to remove petrochemical contaminants from contaminated water using this air stripper system.

Example 2 states that the process mixture used in the vapor reactor 14 was also applied to soil contaminated with petrochemicals. What this portion of the Elgal reference is stating to one of ordinary skill in the art is that the process of treating first with ozone and then hydrogen peroxide can be used in the same apparatus shown in Figures 1 and 2 if an ex situ sample of soil is placed in the reaction system. Thus, in place of the groundwater being treated by the system shown in Figures 1 and 2, soil can be added to the system and the process used to treat the same.

This is not an in situ process but rather an ex situ process. Furthermore, like Nelson-Brown, ozone is used to treat the contaminants as the principle reactant with hydrogen peroxide being added thereafter. To the contrary, the present invention uses hydrogen peroxide as the principle reactant and ozone as the catalyst to

generate hydroxyl radicals which provides greater control over the decontamination process and avoids aggressive reactions at the point of administration.

Feasey is stated to teach stabilization of concentrated hydrogen peroxide solutions. Applicant does not dispute that stabilization of hydrogen peroxide solutions was known prior to the present invention. However, there is no teaching or suggestion in Feasey of a method of treating contaminants in situ wherein hydrogen peroxide is added first, followed by the addition of ozone in a controlled process so as to avoid aggressive reactions at the point of administration which is typically associated with the administration of ozone first into the contaminated in situ environment. Applicant therefore submits that the combination of Nelson-Brown, Elgal and Feasey does not lead one of ordinary skill in the art to the claimed invention which is not obvious thereover.

Claims 1-20 stand rejected as obvious over Watts. Watts is stated to teach soil and/or groundwater remediation processes comprising adding a source of an oxidizing agent to the in situ environment. The rejection is hereby traversed and reconsideration is respectfully requested.

Watts is directed to a method of treating contaminants by adding a source of an oxidizing agent and a reaction product complex of a ligand donor and a metal catalyst. Column 4, beginning at line 12 identifies the sources of oxidizing agents which includes peroxides as well as ozone. Column 4, beginning at line 30 states

that the peroxides and ozone can be used alone (i.e. peroxide or ozone) or they may be used in combination with ultraviolet radiation. However, there is no teaching or suggestion of the importance of treating the in situ environment with hydrogen peroxide alone or simultaneously with ozone in a manner which eliminates aggressive reactions at the point of administration. Furthermore, Watts requires an entirely different system which includes the reaction product complex made from a ligand donor and a metal catalyst.

In view of the foregoing, Applicants submit that the present application is in condition for allowance and early passage to issue is therefore deemed proper and is respectfully requested.

It is believed that no fee is due in connection with this matter. However, if any fee is due, it should be charged to Deposit Account No. 23-0510.

Respectfully submitted,

Allen R. Kipnes, Esquire
Registration No. 28,433
Attorney for Applicant

Address All Correspondence to:
Allen R. Kipnes, Esquire
WATOV & KIPNES, P.C.
P.O. Box 247
Princeton Junction, NJ 08550
(609) 243-0330